Amendments

Please amend the Application, as follows

***In the Drawings*:**

Please amend Fig. 9, as marked in red in the Drawing Correction attached hereafter.

***In the Claims*:**

Please amend claims 13, 23, 31, 33, 34, 41, 43 without any disclaimer and a prejudice.

Please insert new claims 53-77.

The "Marked" version and "Clean" version of the amended claims are provided in the **APPENDIX A and B** attached hereafter.

Remarks

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 13, 23, 31, 33, 34, 41, 43 and drawing 9 are amended and claims 53-77 are newly inserted.

From now on, claims 1-77 are pending, among which claims 1, 13, 23, 31, 33, 34, 40, 41, 47, 48, 52, and 59 are independent claims.

Based on the above amendment and the following Remarks, Applicants respectfully request that the Examiner reconsiders all outstanding objections and rejections and they be withdrawn. Applicants believe that no new matters have been added by this amendment. Attached hereto is a marked-up version of the changes made to the claims by the current Amendment. Furthermore, attached hereto is a clean version of supplemental claims incorporating changes made by the current Amendment, for the Examiner's convenience.

Rejections Under 35 U.S.C. § 103

On page 2-5 of the Office Action, the Examiner rejected claims 1,4-12,17-22,27,30,35-40 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,473,455 issued to Koike et al ("Koike") in view of U.S. Patent No. 5,608,556 issued to Koma ("Koma"). The Examiner further rejected claims 2-3 under 35 U.S.C. 103(a) as being unpatentable over Koike in view of Koma and further in view of U.S. Patent No. 6,141,074 Bos et al. ("Bos"). Applicants respectfully disagree with the Examiner's rejection.

Claim 1 of the present Application recites a liquid crystal display, comprising a plurality of protrusions formed on the common electrode and a pixel electrode having a plurality of apertures formed on the second substrate.

To establish a *prima facie* case of obviousness for a given claim, two requirements must be satisfied. First, the cited requirements must teach or suggest all the features recited in the claim. Second, there must have been some teaching or suggestion in existence at the time the invention was made that would have led on of ordinary skill in the art to combine the references in an attempt to form the claimed invention. Applicants respectfully submit that neither reference, taken individually or in combination, meets these requirements.

The Examiner's reliance on the combination of Koike in view of Koma is misplaced, because neither Koike nor Koma suggests combining the two references to form the claimed invention.

In Koike, Figs. 50 and 51 show the domains A and B defined by a protrusion 26p and depression 22d. The **Liquid Crystal 20 controlling power generated by a protrusion 26p and**

depression 22d to define the domains is just **based on the geometric structure like a protrusion and a depression**. In col. 20, lines 32-43 of Koike, Koike explains such concept as follows: "[T]he Liquid Crystal 20 **has a tendency to align depending on the surface shape of a structure that the Liquid Crystal 20 contacts**. Accordingly, as shown in FIG. 50, molecules of the liquid crystal 20 located near the respective glass plate 16 and 18 at the corners of the portions 22d and 26p are aligned obliquely to the corners of the portions 22d and 26p and this alignment coincides with the alignment caused by the rubbing directions. Accordingly, the portions 22d and 26p of the alignment layers 22 and 26 help the alignment of the liquid crystal 20 to improve the behavior of the liquid crystal 20 at the boundary between the liquid crystal aligning domains A and B." In other words, the Liquid Crystal molecules shown in Koike are controlled by only geometric structures.

In Koma, the LCD shown in Fig. 8 discloses an aperture 33b and a liquid crystal orientation control electrode 22 to divide a pixel into multi-domains. The Liquid Crystal 40 is controlled through the power generated by an aperture 33b and a liquid crystal orientation control electrode 22 to define the domains. The Liquid Crystal 40 is controlled just **based on the electric field.** As shown in Figs. 5 and 9, Koma discloses the multi-domains only defined by the direction of the electric field 42 generated by an aperture and an orientation control electrode. **Koma does not disclose any geometric structure** to provide the Liquid Crystal controlling power.

Therefore, neither of the cited references teaches combination of control of geometric structures and control by electric field.

In the present invention, however, the LCD shown in Fig. 5 as one of embodiment discloses an electrode aperture 270 and a protrusion 170 formed on substrates. The Liquid Crystal 30 controlling power generated **by a electrode aperture 270 and protrusions 170** to define the domains is **based on the electric fringe field caused by the electrode aperture as well as the geometric structure caused by the protrusions**.

In forming multi-domains to provide wide viewing angle of LCD, an electric fringe field method is quite different from using a geometric structure. It is not obvious to combine the two different technologies, as the Examiner alleges. To control the liquid crystal, Koma simply suggests the electrical fringe field in controlling the liquid crystal. Koike suggests the geometric structure. Neither Koma nor Koike suggests to combine the two methods. The Examiner failed to provide any evidence of obviousness in combining these two references. Therefore, it is not obvious for one of ordinary skill in the art to conceive a combination of cited references.

Thus, claim 1 is patentable over the references of record.

Likewise, Claims 2-12, 17-22, 27, 30 and 35-39 that are dependent from claim 1 are also patentable over the references of record.

The Examiner rejected claims 40, 47, and 48 for the same reason. However, each of these claims recites the limitation of comprising a protrusion and an aperture. Therefore, for the same reason as we discussed previously, those independent claims 40, 47 and 48 are all patentable over the references of record. Likewise, claims 44-46 and 49-51 that are respectively dependent from claims 40 and 48 are also patentable over the references of records.

Therefore, Applicants respectfully request that all the outstanding rejections and objections over claims 1-12, 17-22, 27, 30, 35-40 and 44-51 be withdrawn and pass the present pending claims to allowance.

Allowable subject matter

On page 5 of the Office Action, the examiner said that claims 13-16, 23-26, 28-29, 31-34 and 41-43 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

By this amendment, claims 13, 23, 31, 33, 34 and 41are rewritten in independent form including all of the limitations of the base claim and any intervening claims. The other claims depend on the above independent claim.

Therefore, it is respectfully requested that claims 13-16, 23-26, 28-29, 31-34 and 41-43 be passed to allowance.

Other issues

In this amendment, Applicants add new claims 52-77, among which claims 52 and 59 are independent claims.

Claim 52 discloses a first protrusion **having a branch** extending along an edge of the first electrode. Claim 59 discloses a first protrusions and a second protrusions which **meet each other** or the imaginary extension of the first protrusions and the second protrusions **meet each other.**

Applicants believe that none of the cited references of the record in the Office Action disclose each and every element of the claims newly added.

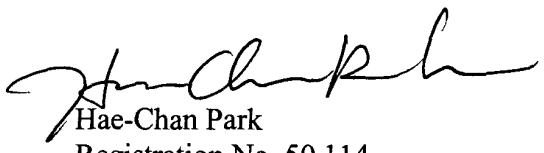
Therefore, it is respectfully requested that new claims 52-77 are patentable over the cited references of the record.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully submitted,



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Attachment : Drawing Correction(s)

APPENDIX A

Marked version of the amended claims

1. A liquid crystal display comprising:

a first substrate;

a common electrode which is formed on the first substrate;

a plurality of protrusions formed on the common electrode;

a second substrate facing the first substrate; and

a pixel electrode having a plurality of apertures formed on the second substrate.

2. The liquid crystal display of claim 1, further comprising a chiral nematic liquid crystal layer having negative dielectric anisotropy which is interposed between the first and the second substrates.

3. The liquid crystal display of claim 2, further comprising two vertical alignment layers which are formed on inner surfaces of the first and the second substrates respectively and align the molecular axes of liquid crystal molecules in the liquid crystal layer in a direction perpendicular to the substrates.

4. The liquid crystal display of claim 1, further comprising a first and a second polarizers attached to outer surfaces of the first and the second substrates respectively, polarizing directions of the first and the second polarizers being perpendicular to each other.

5. The liquid crystal display of claim 4, further comprising a first compensation film attached either between the first substrate and the first polarizer or between the second substrate and the second polarizer.

6. The liquid crystal display of claim 5, wherein the first compensation film is a biaxial compensation film.

7. The liquid crystal display of claim 6, wherein a slow axis of the first compensation film is parallel or perpendicular to the polarizing directions of the first and the second polarizers.

8. The liquid crystal display of claim 5, further comprising a second compensation film attached either between the first substrates and the first polarizer or between the second substrate and the second polarizer.

9. The liquid crystal display of claim 8, wherein the first and the second compensation films are an a-plate and a c-plate compensation films respectively.

10. The liquid crystal display of claim 9, wherein a slow axis of the a-plate compensation film is parallel or perpendicular to the polarizing directions of the first and the second polarizers.

11. The liquid crystal display of claim 4, wherein the apertures have a shape of a wedge-shaped line having width.

12. The liquid crystal display of claim 4, wherein the protrusions have symmetrical cross sections, and have a shape of a wedge-shaped line having width, and the apertures and the protrusions are arranged alternately.

13.(Amended) A liquid crystal display comprising:

a first substrate;

a common electrode which is formed on the first substrate;

a plurality of protrusions formed on the common electrode;

a second substrate facing the first substrate;

a pixel electrode having a plurality of apertures formed on the second substrate; and

a first and a second polarizers attached to outer surfaces of the first and the second substrates respectively, polarizing directions of the first and the second polarizers being perpendicular to each other;

wherein the protrusions have symmetrical cross sections, and have a shape of a wedge-shaped line having width, and the apertures and the protrusions are arranged alternately;

wherein the protrusion has a first branch extending along an edge of the pixel electrode from a position at which the aperture meets the edge of the pixel electrode with an acute angle.

14. The liquid crystal display of claim 13, wherein the width of the first branch decreases as goes from the protrusion to an end of the first branch.

15. The liquid crystal display of claim 14, wherein the protrusion has a second branch extending from a convex point of the protrusion toward the aperture; and

the apeture has an extension extending from a convex point of the aperture toward the protrusion.

16. The liquid crystal display of claim 15, wherein the width of the extension decreases as goes to an end of the extention; and

the width of the second branch decreases as goes to the edge of the pixel electrode.

17. The liquid crystal display of claim 12, wherein the polarizing directions of the first and the second polarizers make an angle of 45° with the aperture and the protrusion.

18. The liquid crystal display of claim 12, wherein the width of the aperture is 3 to 20 microns.

19. The liquid crystal display of claim 18, wherein the width of the protrusion is 3 to 20 microns.

20. The liquid crystal display of claim 19, wherein the distance between the aperture and the protrusion is 5 to 15 microns.

21. The liquid crystal display of claim 20, wherein the height of the protrusion is 0. 3 to 3 microns.

22. The liquid crystal display of claim 4, wherein the aperture has a shape of cross including a first and a second portions crossing each other at a right angle.

23. (Amended) A liquid crystal display comprising:

a first substrate;

a common electrode which is formed on the first substrate;

a plurality of protrusions formed on the common electrode;

a second substrate facing the first substrate;

a pixel electrode having a plurality of apertures formed on the second substrate; and

a first and a second polarizers attached to outer surfaces of the first and the second substrates respectively, polarizing directions of the first and the second polarizers being perpendicular to each other;

wherein the aperture has a shape of cross including a first and a second portions crossing each other at a right angle,

wherein the shape of the protrusion is a tetragon surrounding the aperture.

24. The liquid crystal display of claim 23, wherein the width of the aperture decreases as goes from a center of the aperture to ends of the aperture.

25. The liquid crystal display of claim 24, wherein the center of the cross is diamond-shaped.

26. The liquid crystal display of claim 25, wherein the distance between the apertures is 10 to 50 microns.

27. The liquid crystal display of claim 22, wherein the first and the second portions are parallel to the polarizing axes of the first and the second polarizers respectively.

28. The liquid crystal display of claim 23, wherein the protrusion is located substantially outside edges of the pixel electrode.

29. The liquid crystal display of claim 23, wherein a portion of the protrusion overlaps edges of the pixel electrode.

30. The liquid crystal display of claim 4, wherein the aperture has an X shape including a first and a second portions crossing each other at a right angle.

31. (Amended) A liquid crystal display comprising:

a first substrate;

a common electrode which is formed on the first substrate;

a plurality of protrusions formed on the common electrode;

a second substrate facing the first substrate;

a pixel electrode having a plurality of apertures formed on the second substrate; and

a first and a second polarizers attached to outer surfaces of the first and the second substrates respectively, polarizing directions of the first and the second polarizers being perpendicular to each other,

wherein the aperture has an X shape including a first and a second portions crossing each other at a right angle,

wherein the protrusion surrounds the X shaped aperture.

32. The liquid crystal display of claim 31, wherein the first and the second portions are parallel to the polarizing axes of the first and the second polarizers respectively.

33. (Amended) A liquid crystal display comprising:

a first substrate;

a common electrode which is formed on the first substrate;

a plurality of protrusions formed on the common electrode;

a second substrate facing the first substrate;

a pixel electrode having a plurality of apertures formed on the second substrate; and

a first and a second polarizers attached to outer surfaces of the first and the second substrates respectively, polarizing directions of the first and the second polarizers being perpendicular to each other,

wherein the aperture has an X shape including a first and a second portions crossing each other at a right angle,

wherein the protrusion is located substantially outside edges of the pixel electrode.

34. (Amended) A liquid crystal display comprising:

a first substrate;

a common electrode which is formed on the first substrate;

a plurality of protrusions formed on the common electrode;

a second substrate facing the first substrate;

a pixel electrode having a plurality of apertures formed on the second substrate; and

a first and a second polarizers attached to outer surfaces of the first and the second substrates respectively, polarizing directions of the first and the second polarizers being perpendicular to each other,

wherein the aperture has an X shape including a first and a second portions crossing each other at a right angle,

wherein a portion of the protrusion overlaps edges of the pixel electrode.

35. The liquid crystal display of claim 1, wherein the protrusions are made of polyimide.

36. The liquid crystal display of claim 1, wherein the protrusions are made of photoresist.

37. The liquid crystal display of claim 1, further comprising a black matrix overlapping the protrusions on the second substrate.

38. The liquid crystal display of claim 37, further comprising a wire overlapping the aperture patterns on the first substrate.

39. The liquid crystal display of claim 38, wherein the wire is a gate wire.

40. A liquid crystal display comprising:

a first substrate including a pixel electrode having at least a wedge-shaped aperture; and

a second substrate which is opposite the first substrate and includes a common electrode and at least a wedge-shaped protrusion on the common electrode, the protrusion being parallel and alternate to the aperture.

41. (Amended) A liquid crystal display comprising:

41-49

50. The manufacturing method of the liquid crystal display of claim 49, wherein the step of forming the protrusions comprises the steps of:

coating a photo-sensitive film, exposing the photo-sensitive film, developing the photo-sensitive film, and baking the photo-sensitive film.

51. The manufacturing method of the liquid crystal display of claim 48, further comprising the step of forming vertical alignment layers on the first and the second substrates.

52. (New) A liquid crystal display, comprising:

a first substrate having a plurality of pixel electrodes including a first electrode;

a second substrate opposite the first substrate and including a second electrode; and

a plurality of protrusions provided on at least one of the first and the second substrates, the plurality of protrusions including a first protrusion having a branch extending along an edge of the first electrode.

53. (New) The liquid crystal display of claim 52, wherein the plurality of protrusions are provided on the second substrate.

54. (New) The liquid crystal display of claim 53, further comprising a plurality of apertures provided on the first substrate and including a first aperture.

55. (New) The liquid crystal display of claim 54, wherein an edge of the first aperture is oblique to the edge of the first electrode, and an end of the first aperture is located near the edge of the first electrode.

56. (New) The liquid crystal display of claim 55, wherein the branch extends from the first protrusion toward the end of the first aperture.

57. (New) The liquid crystal display of claim 56, wherein the branch makes an acute angle with the edge of the first aperture.

58. (New) The liquid crystal display of claim 57, wherein the width of the branch decreases as goes from the first protrusion to the end of the first aperture.

59. (New) A liquid crystal display, comprising:

a first substrate having a plurality of pixel electrodes including a first electrode;

a second substrate opposite the first substrate and including a second electrode; and

a plurality of protrusions provided on at least one of the first and the second substrates, the plurality of protrusions including first and second protrusions having shapes of substantially straight lines,

wherein either the first and the second protrusions or imaginary extensions of the first and the second protrusions meet each other.

60. (New) The liquid crystal display of claim 59, wherein the first and the second protrusions are located substantially in an area corresponding to the first pixel electrode.

61. (New) The liquid crystal display of claim 60, wherein the first and the second protrusions are oblique to edges of the first pixel electrode.

62. (New) The liquid crystal display of claim 61, wherein the first and the second protrusions are substantially symmetrically arranged with respect to a first line substantially parallel to the edges of the first pixel electrode.

63. (New) The liquid crystal display of claim 62, wherein each of the first and the second protrusions has first and second ends opposite each other, and the first and the second protrusions either are separated from each other or meet only near the first ends of the first and the second protrusions.

64. (New) The liquid crystal display of claim 63, wherein the first pixel electrode has first to fourth principal edges, the first and the second principal edges are opposite and substantially parallel to each other, the third and the fourth principal edges are opposite and substantially parallel to each other, and the first and the second principal edges are shorter than the third and the fourth principal edges.

65. (New) The liquid crystal display of claim 64, wherein the first line is substantially parallel to the first and the second principal edges.

66. (New) The liquid crystal display of claim 65, wherein the first ends of the first and the second protrusions are located near the third principal edge.

67. (New) The liquid crystal display of claim 66, wherein the second ends of the first and the second protrusions are located near the first and the second principal edges, respectively.

68. (New) The liquid crystal display of claim 65, wherein the second ends of the first and the second protrusions are located near the fourth principal edge.

69. (New) The liquid crystal display of claim 68, wherein the first ends of the first and the second protrusions are located near the first line.

70. (New) The liquid crystal display of claim 69, wherein the plurality of protrusions includes a third protrusion extending from the first ends of the first and the second protrusions toward the third principal edge along the first line.

71. (New) The liquid crystal display of claim 70, wherein width of the third protrusion decreases as goes to the third principal edge.

72. (New) The liquid crystal display of claim 63, wherein the first and the second protrusions form a wedge shape.

73. (New) The liquid crystal display of claim 63, wherein at least one of the first and the second protrusions has a branch extending along an edge of the first pixel electrode.

74. (New) The liquid crystal display of claim 59, wherein one of the first the second electrodes has a plurality of apertures including first and second apertures having shapes of substantially straight lines.

75. (New) The liquid crystal display of claim 74, wherein the first and the second apertures are substantially parallel to at least one of the first and the second protrusions.

76. (New) The liquid crystal display of claim 75, wherein the first and the second apertures are substantially parallel to the first and the second protrusions, respectively.

77. (New) The liquid crystal display of claim 76, wherein the first and the second apertures are alternate to the first and the second protrusions, respectively.

APPENDIX B